

Association Between Exposure to Traffic-Related Air Pollution and Adverse Health Effects in Adults



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Air Resources Board

California Environmental Protection Agency

Thank you Mr. Cackette. Good morning, Chairman Nichols and members of the Board. In this health update, I am going to discuss the health effects of traffic-related air pollution. Earlier this year, I presented effects seen in infants and children and this presentation will focus on health effects found in adults, particularly those with asthma.

Asthma

- **Chronic respiratory disease**
- **Scope of problem in California**
 - 9% of adults have active asthma
 - 500 deaths and 16,000 hospital admissions per year
- **Air pollution and asthma**
 - Traffic-related air pollutants including PM, SO₂, NO_x, and O₃ are associated with asthma attacks and worsening of symptoms



First, I would like to present some background information on asthma.

Asthma is a chronic disease involving the respiratory system. During an asthma attack, the airway constricts, swells, and becomes congested. This leads to tightness in the chest, wheezing, and difficulty breathing. In severe cases, asthma attacks can be deadly. Almost 9% of adults in California have active asthma. Asthma kills approximately 500 Californians a year and it is a contributing cause in thousands of other deaths. Annually, over 16,000 people are hospitalized with asthma and it is responsible for hundreds of thousands of work absences. Air pollution plays a well-documented role in asthma. Traffic-related pollutants such as particulate matter, sulfur dioxide, oxides of nitrogen, and ozone have been found to trigger asthma attacks and worsen symptoms.

Impacts of Traffic Exposure on Poorly Controlled Asthma: Study Design

- **Poorly controlled asthma**
 - Symptoms at least weekly, or
 - Hospitalized for asthma during the past year
- **1,600 adults with asthma in Los Angeles and San Diego Counties**

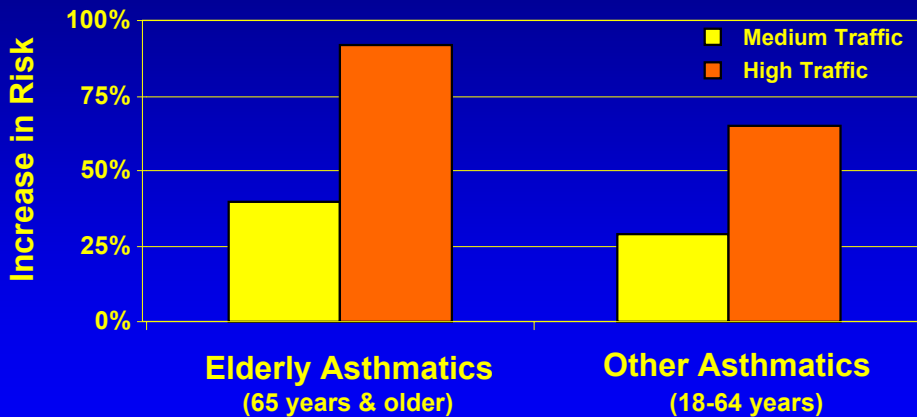


Meng YY, et al. 2007. Traffic and outdoor air pollution levels near residences and poorly controlled asthma in adults. *Annals of Allergy, Asthma, & Immunology*. 98(5):455-63. *Funded by the Agency for Toxic Substances and Disease Registry.*

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In the study I am focusing on today, Dr. Meng and colleagues examined the impacts of traffic on poorly controlled asthma in adults. Poorly controlled asthma is defined as experiencing asthmatic symptoms at least weekly during the past year, or having been hospitalized for asthma in the past year. The investigators followed 1,600 adults diagnosed with asthma and living in Los Angeles and San Diego Counties. They examined whether the asthmatics who lived near areas of heavy or moderate traffic were more likely to have poorly controlled asthma than those living in areas with low levels of traffic.

Traffic-Associated Increases in Poorly Controlled Asthma in Adults



The results of the study are shown in this graph. The orange bars represent the percentage increase in risk of poorly controlled asthma among those living in areas of high traffic while the yellow bars show the increase in risk among those living in areas of medium traffic. These are all in comparison to those living in areas of low traffic. The researchers found that elderly adults living near areas of medium traffic had approximately a 40% increase in risk and those living near areas of heavy traffic had a 90% increase in risk of suffering from poorly controlled asthma. Younger adults experienced 25% and 60% increases in risk, respectively. These results are important because poorly controlled asthma has such a negative impact on the quality of life. This study is one example of a small but growing body of literature that shows a number of health effects from traffic on adults.

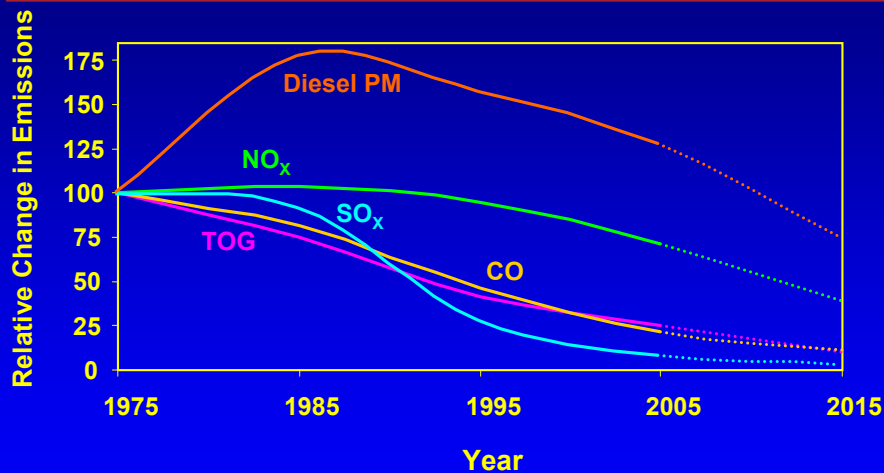
Other Traffic-Related Health Effects in Adults

Health Effects	Short-term Exposure	Long-term Exposure
Death from cardiovascular causes	X	X
Death from respiratory causes	X	X
Hospital admissions	X	X
Atherosclerosis		X
Lung and breast cancer		X



I will now discuss other health effects seen in adults exposed to traffic-related pollution. Researchers conducting studies in the United States have examined health effects related to short-term traffic pollution exposure lasting just a few days, and recently, to long-term pollution exposures lasting years. Studies of short-term exposure to pollution have found increases in risk of death from cardiovascular causes such as heart attacks and strokes. Increases in risk of death from respiratory causes have also been found, as well as an increased risk of hospital admissions. As shown in the table, long-term exposure can lead to the same health outcomes as those with short-term exposure but additional risks are observed. For example, there is an increased risk of developing atherosclerosis, which can lead to heart disease. Additionally, increased risks of lung and breast cancer have been found in people who have been exposed to traffic-related pollutants for a long time.

Trends in Emissions of Traffic-Related Pollutants



Since 1975, the population in California has almost doubled and the number of vehicles on the road has tripled. However because of regulatory actions to mitigate health problems associated with traffic-related pollution, emissions of many of these pollutants have decreased markedly over the decades. This graph demonstrates how the amount of on-road vehicular emissions of oxides of nitrogen and sulfur, total organic gases, and carbon monoxide have decreased over the years, relative to 1975. Traffic-related diesel PM emissions rose through the 1980s until the first heavy duty diesel standards went into effect and have since declined. All of these emissions are forecast to drop even more with the recent implementation of tighter emission standards. The dotted lines represent emissions forecast to the year 2015. The graph does not show ultrafine particle emissions or PM sources such as road dust, brake wear, and tire rubber.

Current ARB Research Studies on Traffic and Health

- Cardiovascular effects in seniors during freeway travel
- Air pollution and heart disease among California teachers
- Toxicity of PM from heavy and light-duty vehicles
- Respiratory effects among bicycle commuters
- Traffic-related pollution and deaths
- Traffic, socioeconomic status, and asthma



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While we have made significant strides in cleaning the air, additional research is needed to ensure our regulations are protective for even the most sensitive groups of people. As shown here, ARB is currently funding several studies on the effects of traffic on health. The first two studies are examining the health effects of traffic pollutants on the elderly (1,2). The third study will attempt to separate the health effects of particles from gasoline and diesel vehicles (3).

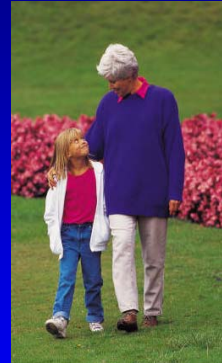
The next two studies are in-house research projects assessing the effects of traffic pollutants. In one of the studies, we will look at the effects of traffic-related pollution on respiratory function in bicycle commuters, with a focus on ultrafine particle exposure.

The final study listed was approved by the Board last month and will assess the relationship between traffic-related pollution, socioeconomic status, and asthma (4).

1. Cardiovascular Health Effects of Fine and Ultrafine Particles during Freeway Travel. \$500,000, UCI; Dr. Ralph Delfino,
2. Air Pollution and Cardiovascular Disease in the California Teachers Study Cohort. \$284,652, DPH; Dr. Michael Lipsett.
3. Physiochemical and toxicological assessment of the semi-volatile and non-volatile fractions of PM from heavy- and light-duty vehicles operating with and without emissions control technologies. \$677,950, USC; Dr. Constantinos Sioutas.
4. Is disparity in asthma among Californians due to higher pollutant exposures, greater susceptibility or both? \$299,974; UCLA, Dr. Yingying Meng.

Conclusions

- **Traffic-related air pollution is associated with increased risk of disease and death**
 - 1 million Californians live within 100 meters of a freeway
 - ~50% of Californians live within 1 mile of a freeway
- **Land use guidelines need to be taken into account**



The results presented today show that traffic-related air pollution is associated with an increased risk of disease and death. This is particularly problematic since approximately 1 million people live within 100 meters of a freeway and almost half of California's population live within 1 mile of a freeway. Reducing emissions is not the only way to protect the people of California. As our population and the number of vehicles continue to increase, we should also take into account using our land in such a way as to reduce or altogether avoid exposures to traffic. Our continuing efforts in research, our control measures, and guidelines will help protect our most vulnerable populations from traffic-related air pollution. This concludes my presentation, we will be happy to answer any questions.